

CLAIMS

1. A method of operating a vehicle control system, the method comprising:
 - 5 determining a plurality of measured vehicle variables;
 - determining at least one suspension force based on at least one of the determined measured vehicle variables;
 - determining at least one tire vertical force based on the at least one determined suspension force and at least one of the determined measured vehicle variables;
 - 10 determining at least one tire longitudinal force based on at least one of the determined measured vehicle variables;
 - determining at least one axle lateral force based on at least one of the determined measured vehicle variables;
 - determining at least one tire lateral force based on the at least one determined axle lateral force and the at least one determined tire vertical force; and
 - 15 modulating at least one control component of the vehicle control system based on the at least one determined tire vertical force, the at least one determined tire longitudinal force, and the at least one determined tire lateral force.
- 20 2. The method of claim 1 wherein the measured vehicle variables comprise at least one variable selected from a group consisting of longitudinal acceleration, lateral acceleration, vertical acceleration, wheel vertical acceleration, roll rate, pitch rate, yaw rate, wheel speed, steering angle, brake torque, drive torque, and vehicle speed.
- 25 3. The method of claim 1 wherein determining a plurality of measured vehicle variables comprises sensing at least one of acceleration, speed, torque, inertia, yaw, rotation, and angle.

4. The method of claim 1 wherein the control component comprises at least one of a controllable suspension, an anti-lock braking system, a traction control system, a vehicle stability enhancement system, an active rear steering system, and an anti-rollover system.

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5. The method of claim 1 further comprising determining a parameter adaptation.

6. The method of claim 5 wherein the parameter adaptation comprises a vehicle load condition estimate.

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7. A computer usable medium including a program for operating a vehicle control system, the computer usable medium comprising:

computer readable program code for determining a plurality of measured vehicle variables:

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computer readable program code for determining at least one suspension force based on at least one of the determined measured vehicle variables;

computer readable program code for determining at least one tire vertical force based on the at least one determined suspension force and at least one of the determined measured vehicle variables;

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computer readable program code for determining at least one tire longitudinal force based on at least one of the determined measured vehicle variables;

computer readable program code for determining at least one axle lateral force based on at least one of the determined measured vehicle variables;

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computer readable program code for determining at least one tire lateral force based on the at least one determined axle lateral force and the at least one determined tire vertical force; and

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computer readable program code for modulating at least one control component of the vehicle control system based on the at least one determined tire vertical force, the at least one determined tire longitudinal force, and the at least one determined tire lateral force.

8. The computer usable medium of claim 7 wherein the measured vehicle variables
comprise at least one variable selected from a group consisting of longitudinal
acceleration, lateral acceleration, vertical acceleration, wheel vertical acceleration, roll
5 rate, pitch rate, yaw rate, wheel speed, steering angle, brake torque, drive torque, and
vehicle speed.

9. The computer usable medium of claim 7 wherein the control component
comprises at least one of a controllable suspension, an anti-lock braking system, a
10 traction control system, a vehicle stability enhancement system, an active rear steering
system, and an anti-rollover system.

10. The computer usable medium of claim 7 further comprising computer readable
program code for determining the dynamic tire forces for a plurality of vehicle wheels.
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11. The computer usable medium of claim 7 further comprising computer readable
program code for determining a parameter adaptation.

12. The computer usable medium of claim 11 wherein the parameter adaptation
20 comprises a vehicle load condition estimate.

13. A vehicle control system comprising:
means for determining a plurality of measured vehicle variables:
means for determining at least one suspension force based on at least one of the
5 determined measured vehicle variables;
means for determining at least one tire vertical force based on the at least one
determined suspension force and at least one of the determined measured vehicle
variables;
means for determining at least one tire longitudinal force based on at least one of
10 the determined measured vehicle variables;
means for determining at least one axle lateral force based on at least one of the
determined measured vehicle variables;
means for determining at least one tire lateral force based on the at least one
determined axle lateral force and the at least one determined tire vertical force; and
15 means for modulating at least one control component of the vehicle control
system based on the at least one determined tire vertical force, the at least one determined
tire longitudinal force, and the at least one determined tire lateral force.
14. The system of claim 13 wherein the means for determining a plurality of
20 measured vehicle variables comprises means for sensing at least one of acceleration,
speed, torque, inertia, yaw, rotation, and angle.
15. The system of claim 13 wherein the control component comprises at least one of a
controllable suspension, an anti-lock braking system, a traction control system, a vehicle
25 stability enhancement system, an active rear steering system, and an anti-rollover system.
16. The system of claim 13 further comprising means for determining dynamic tires
forces for a plurality of vehicle wheels.

17. The system of claim 13 further comprising means for determining a parameter adaptation.

5 18. The system of claim 17 wherein the means for the parameter adaptation comprises means for estimating a vehicle load condition.